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Relative Trajectories of Falling, Evaporating Drops MICHAEL ROTHER, University of Minnesota Duluth — Binary interactions are determined for spherical drops due to gravity, with exact methods for calculating the hydrodynamic forces at finite Stokes number and low Reynolds number. Mass is lost by the drops through isothermal evaporation controlled by diffusion, and bispherical coordinates are used to solve for the vapor concentration between the two liquid spheres. At small Reynolds number, the surrounding fluid inertia is negligible, and the hydrodynamic forces are linear functions of the translational velocities of the drops. However, at nonzero Stokes numbers, drop inertia must be taken into account, and the hydrodynamic forces do not balance the applied forces. For drops in close approach, lubrication forces and attractive molecular forces are considered. Comparison with trajectories for two drops of constant mass permits study of the evaporative effect, while comparison of trajectory results with those for two interacting drops, each evaporating at the isolated drop rate, allows analysis of the significance of the presence of the second drop. An important application is to raindrop growth. For water droplets in the atmosphere, at drop radii between 10 and 30 μm, drop inertia is substantial while the Reynolds based on the surrounding air is still small.

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